

UniOP VT100 Terminal Emulation - Ver. 3.16

This tech note describes the operation of the VT100 emulation software on UniOP. This document is a short reference for VT100 Terminal Emulation software. It discusses SetUp screens, supported escape sequences and other features of VT100 terminal and project file for the application.

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1. Revision History

Revision 01	December 24, 93	Description of VT100 Release 3.02 including support of double sized characters
Revision 02	February 8, 94	Description of VT100 Release 3.03 including support of multi drop commands and Report commands
Revision 03	March 5, 94	Description of VT100 Release 3.04 including support for cursor enable/disable commands.
Revision 04	April 6, 94	Description of VT100 Release 3.07 including support of reverse attribute.
Revision 05	October 13, 95	Description of VT100 Release 3.09 including support of LED's and display of pages from the project file.
Revision 06	December 5, 95	Description of VT100 Release 3.10 including support for brightness control and for 8 bit characters.
Revision 07	February 18, 96	Description of VT100 Release 3.11.
Revision 08	March 28, 96	Description of VT100 Release 3.12 including support for buzzer control.
Revision 09	June 19, 96	Description of VT100 Release 3.13, including support for enabling / disabling autowrap.
Revision 10	December 2, 96	Description of VT100 Release 3.15, including support for NumLock and AT-F keyboard.
Revision 11	March 25, 97	Description of VT100 Release 3.16, including support for backlight control.

2. SetUp

When the VT100 panel is powered up it enters Terminal mode. In this mode the panel functions as a standard VT100 terminal. It displays characters received from the host and it can, itself, send characters to the host. The VT100 panel offers another mode of operation called SetUp mode. In this mode the panel can be configured according to the users requirements.

SetUp mode is entered from within Terminal mode by holding the ENTER key pressed for 2 seconds. When SetUp mode is entered the main SetUp menu is displayed. From this menu, the user can select which aspect of the VT100 panel to configure.

Before describing the content of the menus, the method of menu navigation will briefly be described.

2.1. Navigation and selection in menus

The VT100 panel offers features to enable the user to easily navigate through the menu items.

The keys on the internal keyboard can be used to select and change menu items. Auto repeat is enabled for the navigation keys (except for ENTER) to make menu selections faster.

- Up and down arrows can be used to move between menu items.
- As an alternative to using the Up and Down arrows to select another item, the numeric keys 0 and 1 can be used. The 0 key performs the same action during menu selection as the Up arrow. The 1 key performs the same action as the Down arrow. This is useful if the internal keyboard contains the numeric keys but not the Up and Down arrows.
- On some panels, there are not enough rows to display all of the menu items on the screen at the same time. In this case, automatic scrolling will occur when the user uses the Up and Down arrow keys.
- Some menu items begin with the prompt "->". Pressing ENTER while such an item is selected causes a new menu to be displayed.
- Context sensitive help messages are displayed. For example: Move=UP/DWN,Do=ENTER.
- If a menu item is a user configurable value (e.g. communication parameters) then the left and right arrow keys can be used to select the required value. While such an item is selected, a help message is displayed as follows: Select=LEFT/RIGHT.
- If a menu item does not contain a user configurable value, but instead performs some function (e.g. save or restore setting), then pressing ENTER while the item is selected performs that function. After successful completion a message is displayed as follows: Done.

It is possible to exit from any SetUp menu, apart from inside the key definition menu, by holding the ENTER key pressed for 2 seconds. The organization of menus is as follows:

- The first row on the screen is used for one the menu heading: Main menu, Communication menu, Function keys menu, Service keys menu.
- The last row on the screen is reserved for messages that aid the user in the navigation through the menu items.
- The other rows contain the menu items, with the name on the left and the value on the right side.
- The menu heading is not visible on panels with only two rows. In this case, the first row contains one menu item, and the second is used for help and status messages.
- The selected item name is highlighted.

2.2. The Main SetUp Menu.

The main SetUp menu appears as shown below:

Main menu

```
-> Communication
-> Function keys
-> Service keys
Save setting
Recall setting
Default setting
Terminal mode ->
Configuration mode->
```

While in the main menu, there are two ways to return to Terminal mode. The menu item Terminal mode -> can be selected, or the ENTER key can be pressed for 2 seconds. for exit from SetUp mode. On the return to terminal mode, the screen will be cleared and the serial communication reinitialized, possibly with the new parameters defined during the use of the menu.

To exit from the VT100 emulation application to the configuration mode of UniOP, press ENTER while the Configuration mode-> item is selected. After this, page mode is entered. It is the responsibility of the system controller to have defined a page in the project file to provide a help screen with a message of how to enter configuration mode, or how to return to the VT100 emulation at this point.

Choosing the menu item Save setting causes the VT100 panel to make a permanent record of the current settings, possibly specified during the current use of the menu. On subsequent power downs and power ups of the panel, these saved settings will be used to initialize the system. It should be noted that the VT100 panel will only be able to remember these settings after a power down, if the panel has battery backed up memory.

Choosing the menu item Recall setting causes the VT100 panel to reinitialize itself based on the settings previously saved by using the Save setting menu item.

Choosing the menu item Default setting causes the VT100 panel to reinitialize itself based on the default system settings. These default values are described in the next sections, where the contents of the Communication, Function keys and Service keys menus are described.

2.3. The Communication Menu

The Communication menu, together with the default values of the Communication menu items are as shown below:

Communication menu

-> Function keys

-> Main menu

Speed: 9600

Data bits: 8

Parity: NO

Stop bits: 1

XON/XOFF: YES

Multi Drop: NO

Node ID: 0

Next Node ID: 0

While in the Communication menu the user can return to the Main menu by selecting the -> Main menu item. Alternatively the user can go directly to the Function keys menu by selecting the -> Function keys menu item.

The user can select the required Baud rate for communication between the VT100 panel and the host unit with the Speed menu item. The supported Baud rates are: 150, 300, 600, 1200, 2400, 4800, 9600 and 19200.

The user can select the required number of Data bits for communication between the VT100 panel and the host unit with the Data bits menu item. The supported number of Data bits are: 7 or 8.

The user can select the required Parity for the communication between the VT100 panel and the host unit with the Parity menu item. The supported Parity settings are: NO, ODD or EVEN.

The user can select the required number of Stop bits for the communication between the VT100 panel and the host unit with the Stop bits menu item. The supported number of Stop bits are: 1 or 2.

The user can specify whether the VT100 panel should use software flow control to prevent overrun in the communication buffers, with the XON/XOFF menu item. The supported settings are YES or NO. If NO is selected then the VT100 panel will ignore any XON or XOFF characters sent from the host and it will not try to control overrun of its Receive buffer by sending XON or XOFF characters to the host. If YES is selected then the VT100 panel will both handle and transmit XON and XOFF characters where appropriate. The VT100 panel uses the ASCII character DC1 (11 Hexadecimal) as the XON character and the ASCII character DC3 (13 Hexadecimal) as the XOFF character.

The VT100 panels can operate either in Point to Point or in Multi Drop configurations. In the Point to Point configuration a single VT100 panel is connected to a single host. In the Multi Drop configuration a number of VT100 panels, all sharing the same Transmit and Receive line are connected to a single host. The Multi Drop configuration is explained in depth in a later section. The user can select which configuration is required with the Multi Drop menu item. The possible selections are NO or YES. If NO is selected then the VT100 panel operates in a Point to Point configuration, if YES is selected it operates in a Multi Drop configuration.

If the VT100 panel is configured to operate in a Multi Drop configuration, then each panel must be assigned a unique ID number. This ID number can be assigned with the menu item Node ID. The possible values are 0 - 255.

If the VT100 panel is configured to operate in a Multi Drop configuration, then the panels can be placed into a network ring by specifying, for each panel, the ID of the next panel to which it is attached. The ID number of the next panel can be assigned with the menu item Next Node ID. The possible values are 0 - 255.

2.4. The Function Keys Menu

The Function keys menu, together with the default values of the strings assigned to the function keys are as shown below:

Function keys menu

-> Service keys

-> Main menu

F1:	esc OP
F2:	esc OQ
F3:	esc OR
F4:	esc OS
F5:	esc Ow
F6:	esc Ox
F7:	esc Oy
F8:	esc Om
F9:	esc Ot
F10:	esc Ou
F11:	esc Ov
F12:	esc Ol
F13:	esc Oq
F14:	esc Or
F15:	esc Os
F16:	esc Op
F17:	esc On
F18:	esc OM
F19:	ctl J
F20:	ctl H
F21:	esc F21
F22:	esc F22
F23:	esc F23
F24:	esc F24
F25:	esc F25
F26:	esc F26
F27:	esc F27
F28:	esc F28
F29:	esc F29
F30:	esc F30
F31:	esc F31
F32:	esc F32

F33: esc F33
F34: esc F34
F35: esc F35
F36: esc F36

While in the Function keys menu the user can return to the Main menu by selecting the -> Main menu item. Alternatively the user can go directly to the Service keys menu by selecting the -> Service keys menu item.

Each function key is assigned a default string. When the function key is pressed the string associated with it is sent to the host. Different escape sequences can be sent to the host unit by pressing different function keys. The string assigned to each function key can be changed by the user.

The main part of the above menu is the definitions of the strings for the function keys. These menu items have two parts: the name of the key and the definition of the sequence that will be sent when that key is pressed during terminal mode of operation. Control keys in the sequence are represented with their highlighted **ctl** or **esc**(e.g. Ctrl-C is **ctlC**, ESC is highlighted **ctl[** or **esc**). Note that this is a minor change to the VT100 specification.

The keyboard is used to change the key definitions in the following manner:

- Pressing ENTER while on the selected function key item, enters key definition edit mode.
- Pressing left or right arrow, also enters the key definition mode.
- The left and right arrows move the cursor and select the position in the string.
- The up and down arrows can be used to select the required character at the current position.
- If an ASCII keyboard is present, it can be used to type the new key definition directly.
- Erasing and inserting a string is not possible.
- ENTER is used to exit key definition mode.

During key definition, the following help message is displayed:

Move=LEFT/RIGHT,Select=UP/DWN,Exit=ENTER.

On exit, trailing spaces in the key definition are ignored. If the sequence contains only spaces, the sequence is replaced by a single space. Exit from key definition edit mode is signaled by the following message: Key redefined.

On screens with only 20 columns, only the first 10 characters of the key definition are visible. Also, in this case, the key definition is not edited at the same place where it is displayed. Instead, the last row is used for editing. Also in this case, the maximum key definition length is limited to 20 characters. On screens with greater than 20 columns the maximum key definition length is 30 characters.

As a convenience, a shortcut method of entering the Function keys menu is available. While in SetUp mode, the Function keys menu can be activated by pressing any function key. Furthermore, the appropriate function key string will be displayed, ready for editing, when the corresponding function key is pressed.

Note that characters 80 - FF Hexadecimal cannot be used in the configuration of the Keys.

2.5. The Service Keys Menu

The Service keys menu, together with the default values of the strings assigned to the service keys are as shown below:

Service keys menu

-> Communication

-> Main menu

Ins:

PrtSc:

PrtAlm:

DATA: DATA

TIMER: TIMER

COUNTER: COUNTER

INPUT: INPUT

OUTPUT: OUTPUT

FLAG: FLAG

ENABLE: ENABLE

HELP: ,

CLEAR: **ct**H (Backspace)

While in the System keys menu the user can return to the Main menu by selecting the -> Main menu item. Alternatively the user can go directly to the communication menu by selecting the -> Communication menu item.

Each system key is assigned a default string. When the system key is pressed the string associated with it is sent to the host. Different escape sequences can be sent to the host unit by pressing different system keys. The string assigned to each system key can be changed by the user.

The method of assigning strings to the system keys is exactly the same as assigning strings for the function keys as described above.

3. VT100 emulation

The VT100 panels have the following characteristics:

- An 8-bit character set is used. This is an extension to the VT100 standard which uses 7-bit characters.
- There is no local echo.
- Characters are received from the host in a queue before processing and XON/XOFF protocol can be enabled to prevent overload of that queue.
- Characters to be sent to the host are placed into a queue before transmission. The host can use XON/XOFF protocol to control the transmission of these characters, if XON/XOFF is enabled in the panel, to prevent overload of its own queue.
- Characters received from the host are displayed by the panels if they are within the ASCII range 20 - 7E or 80 - FF Hexadecimal. The DEL character (Hexadecimal 0x7F is ignored)
- Received escape sequences that are erroneous, not recognized or unsupported are ignored.

- Control functions are performed without displaying character(s) to represent the function.
- Characters moved outside the margins are lost.
- Cursor can not be positioned outside the margins.
- All displayed characters can be erased.
- Received characters replace characters at the cursor position.
- Keyboard can not be disabled.
- Positioning units are characters and lines.

3.1. Keyboard use

- Arrows on internal keyboard are used as cursor keys and generate normal cursor sequences.
- Enter generates carriage return.
- Numerical keys on external numerical keypad generate corresponding ciphers.
- Function and service keys are user definable. By default they generate application keypad sequences or names of corresponding keys.
- Keys on ASCII keyboard generate appropriate alphanumeric or control characters.
- Auto repeat is active for cursor keys and ASCII keyboard.

The Arrow keys and Enter key, when pressed, send the following escape sequences to the host:

Key	Normal
↑	esc [A
↓	esc [B
→	esc [C
←	esc [D
ENTER	CR

3.2. Escape sequences

The following table lists the supported control characters and the response of the VT100 panel when they are received:

	Short	HEX	Function
Null	NUL	00	ignored
Backspace	BS	08	move cursor left
Tab	HT	09	move cursor to the next tab stop
Line feed	LF	0A	linefeed or new line
Vertical tab	VT	0B	same as line feed
Form feed	FF	0C	same as line feed
Return	CR	0D	left margin of current line
XON	DC1	11	continue transmitting
XOFF	DC3	13	stop transmitting
*BELL	BEL	07	sounds the bell tone
Escape	ESC	1B	start escape sequence

* Not all types of panels contain a buzzer. Reception of the BEL character has no effect on panels that do not have a buzzer.

Two types of escape sequences are recognized and at least ignored if sequence is not supported.

- Escape sequence (ANSI):
- ESC + 0 or more chars in range 0x20 - 0x2F + final character in range 0x30 - 0x7E
- Control sequence (ANSI):
- ESC + [+ 0 or more chars in range 0x20 - 0x3F + final character in range 0x40 - 0x7E

The following table lists the escape sequences that are supported by the VT100 panels:

Command	Command Sequence
Cursor up one line	ESC [A
Cursor down one line	ESC [B
Cursor right one column	ESC [C
Cursor left one column	ESC [D
Cursor up	ESC [nn A
Cursor down	ESC [nn B
Cursor right	ESC [nn C
Cursor left	ESC [nn D
Cursor position	ESC [ll ; cc H
Cursor home	ESC [H
Cursor On	ESC [? 25 h
Cursor Off	ESC [? 25 l
Autowrap On	ESC [? 7 h
Autowrap Off	ESC [? 7 l
Horizontal and Vertical position	ESC [ll ; cc f
Index	ESC D
Reverse Index	ESC M
Next Line	ESC E
Save cursor and attributes	ESC 7
Restore cursor and attributes	ESC 8
Scroll Up	ESC [nn S
Scroll Down	ESC [nn T
Exit attribute mode	ESC [m
Exit attribute mode	ESC [0 m
Bold	ESC [1 m
Blink	ESC [5 m
Reverse	ESC [7 m
Double height line (top)	ESC # 3
Double height line (bottom)	ESC # 4
Single width line	ESC # 5
Erase to end of line	ESC [K
Erase to end of line	ESC [0 K
Erase from beginning of line	ESC [1 K
Erase entire line	ESC [2 K
Erase to end of screen	ESC [J
Erase to end of screen	ESC [0 J
Erase from beginning of screen	ESC [1 J
Erase entire screen	ESC [2 J
Show page	ESC [nn P
Set LED on	ESC [nn q
Set LED off	ESC [nn x
Set all LED's off	ESC [0 x
Set Buzzer on	ESC [65 q
Set Buzzer off	ESC [65 x
Increase Panel Brightness	ESC [? 5 h
Decrease Panel Brightness	ESC [? 5 l
Increase Panel Backlight	ESC [? 6 h
Decrease Panel Backlight	ESC [? 6 l
Set Full Panel Backlight Intensity	ESC [? 6 f
Turn Off Panel Backlight	ESC [? 6 o
Identify Terminal	ESC Z

Receive Control	ESC [nn {
Transmit Continuous Control	ESC [nn }
Transmit Short-Span Control	ESC [nn

3.2.1. Cursor Positioning

CURSOR UP: ESC [nn A

Function: The cursor is moved up. The cursor stops at the top of the scroll region.

nn: Number of lines to move up.

CURSOR DOWN: ESC [nn B

Function: The cursor is moved down. The cursor stops at the bottom of the scroll region.

nn: Number of lines to move down.

CURSOR RIGHT: ESC [nn C

Function: The cursor is moved right. The cursor stops at the right margin.

nn: Number of characters to move right.

CURSOR LEFT: ESC [nn D

Function: The cursor is moved left. The cursor stops at the left margin.

nn: Number of characters to move left.

CURSOR POSITION: ESC [nn; pp H

Function: The cursor is moved to the specified character line and column. The line and column numbers start from 1. If a value of 0 is used, or if a parameter is missing, a value of 1 is assumed. If the row or column is greater than the actual number then the largest possible number is used.

nn: Line number.

pp: Column number.

CURSOR HOME: ESC [H

Function: The cursor is moved to line 1 column 1. The contents of the screen are not changed.

HORIZONTAL AND VERTICAL POSITION: ESC [nn; pp f

Function: The same as Cursor Position.

nn: Line number.

pp: Column number.

INDEX: ESC D

Function: Move the cursor down one line, but keep it in the same character column. If the cursor is already at the bottom of the scrolling region then the screen scrolls up one line.

REVERSE INDEX: ESC M

Function: Move the cursor up one line, but keep it in the same character column. If

the cursor is already at the top of the scrolling region then the screen scrolls down one line.

NEXT LINE: ESC E

Function: Move the cursor to the start of the next line. If the cursor is already at the bottom of the scrolling region then the screen scrolls up one line.

SAVE CURSOR: ESC 7

Function: Saves the current cursor position and character attribute.

RESTORE CURSOR: ESC 8

Function: Restores the cursor to the position that it was at when the Save Cursor command was received. The character attribute at that time is also restored.

CURSOR ON: ESC [? 25 h

Function: Turns on the text cursor making it visible on the screen. This is the default.

CURSOR OFF: ESC [? 25 l (lower case L)

Function: Turns off the text cursor making it invisible on the screen.

AUTOWRAP ON: ESC [? 7 h

Function: Turns on autowrap mode. In this mode displayable characters that are received when the cursor is at the right border of the page are displayed at the beginning of the next line. If the cursor is at the right border of the page and on the last row then the page scrolls up by one row on receipt of a displayable character. This is the default.

AUTOWRAP OFF: ESC [? 7 l (lower case L)

Function: Turns off autowrap mode. In this mode displayable characters that are received when the cursor is at the right border of the page overwrite the character at this location, however no line feeds or page scrolling occurs; the cursor remains at the right border of the page.

3.2.2. Scroll

SCROLL UP: ESC [nn S

Function: The scroll region is scrolled up one line.
nn: Number of lines to scroll up.

SCROLL DOWN: ESC [nn T

Function: The scroll region is scrolled down one line.
nn: Number of lines to scroll down.

3.2.3. Character Attributes

EXIT ATTRIBUTE MODE: ESC [m or ESC [0 m

Function: All character attributes are turned off for new characters that are received. Previously received characters with attributes retain their attributes until overwritten by new characters.

BOLD ATTRIBUTE ON: ESC [1 m

Function: All newly received characters are displayed as highlighted. If the characters are subsequently moved, the attributes move with them. Previously received characters with attributes retain their attributes until overwritten by new characters. A character with a bold attribute is displayed as a standard character surrounded by a blinking solid surround.

BLINK ATTRIBUTE ON: ESC [5 m

Function: All newly received characters are displayed as blinking. If the characters are subsequently moved, the attributes move with them. Previously received characters with attributes retain their attributes until overwritten by new characters. A character with a blinking attribute is displayed as a blinking standard character.

REVERSE ATTRIBUTE ON: ESC [7 m

Function: All newly received characters are displayed in reverse. If the characters are subsequently moved, the attributes move with them. Previously received characters with attributes retain their attributes until overwritten by new characters.

DOUBLE HEIGHT LINE (TOP): ESC # 3

Function: The row given by the current cursor position is marked as a double height line (top). All newly received characters are displayed as the top halves of double sized characters. The newly received characters have a width of 2 standard sized characters and the height of a single standard sized character. To display text of double width and double height characters it is necessary to send the same text to the panel two times. Once preceded by the ESC # 3 escape sequence for the top half of the text, and then, on the next line, preceded by the ESC # 4 escape sequence for the bottom half of the text..

Any characters that are forced off the screen are lost. When a line feed occurs at the end of a double sized line, the double height attribute is not automatically carried onto the next line. Any character attributes are maintained and effect the whole of the double sized character.

DOUBLE HEIGHT LINE (BOTTOM): ESC # 4

Function: The row given by the current cursor position is marked as a double height line (bottom). All newly received characters are displayed as the bottom halves of double sized characters. The newly received characters have a width of 2 standard sized characters and the height of a single standard sized character. To display text of double width and double height characters it is necessary to send the same text to the panel two times. Once preceded by the ESC # 3 escape sequence for the top half of the text, and then, on the next line, preceded by the ESC # 4 escape sequence for the bottom half of the text.

Any characters that are forced off the screen are lost. When a line feed occurs at the end of a double sized line, the double height attribute is not automatically carried onto the next line. Any character attributes are maintained and effect the whole of the double sized character.

SINGLE WIDTH LINE: ESC # 5

Function: The row given by the current cursor position is marked as a single height line. This is the default character size. All newly received characters, are displayed as single sized characters in both width and height. When a line feed occurs at the end of a single sized line, the single size attribute is not carried onto the next line if the next line currently has a double sized attribute. Any character attributes are maintained.

3.2.4. Editing**ERASE LINE FROM CURSOR: ESC [K or ESC [0 K**

Function: Erase from the cursor (inclusive) to the end of the line.

ERASE LINE TO CURSOR: ESC [1 K

Function: Erase from the beginning of the line to the cursor (inclusive).

ERASE LINE: ESC [2 K

Function: Erase the entire line where the cursor is positioned.

ERASE SCREEN FROM CURSOR: ESC [J or ESC [0 J

Function: Erase from the cursor (inclusive) to the end of the screen.

ERASE SCREEN TO CURSOR: ESC [1 J

Function: Erase from the beginning of the screen to the cursor (inclusive).

ERASE SCREEN: ESC [2 J

Function: Erase the entire screen.

SHOW PAGE: ESC [nn P

Function: Show page nn of the project file to the screen.

NON-STANDARD EXTENSION

3.2.5. LED / Buzzer Control

SET LED ON: ESC [nn q

Function: Turns on one LED indicator.
nn: Number of the LED to turn on (1-64).
NON-STANDARD EXTENSION

SET LED OFF: ESC [nn x

Function: Turns off one LED indicator.
nn: Number of the LED to turn on (1-64).
NON-STANDARD EXTENSION

SET ALL LED OFF: ESC [0 x

Function: Turns off all LED indicators.
NON-STANDARD EXTENSION

*SET BUZZER ON: ESC [65 q

Function: Turns on the buzzer
NON-STANDARD EXTENSION

*SET BUZZER OFF: ESC [65 x

Function: Turns off the buzzer.
NON-STANDARD EXTENSION

* Not all types of panels contain a buzzer. The Buzzer Control commands have no effect on panels that do not contain buzzers.

3.2.6. Reports

DEVICE STATUS: ESC [5 n

Function: The host requests the panel to inform it of its operating status.
Response: No malfunction: ESC [0 n
Malfunction: ESC [3 n

CURSOR POSITION REPORT: ESC [6 n

Function: The host requests the panel to inform it of its cursor position
Response: ESC [nn; pp R
nn: Vertical cursor position
pp: Horizontal cursor position

IDENTIFY TERMINAL: ESC Z

Function: The host requests the panel to identify itself
Response: ESC [? nn; pp c
nn: Node ID as entered in Communication menu
pp: Next Node ID as entered in Communication menu

3.2.7. Multi Drop

RECEIVE CONTROL: ESC [nn {

Function: Host designates the specified panel as an Enabled Receiver.
All other panels are designated as Disabled Receivers.
nn: (0 - 255) Node ID of the panel to be enabled as a Receiver. If the value is 0 then all panels are enabled as Receivers.

TRANSMIT CONTINUOUS CONTROL: ESC [nn }

Function: Host designates the specified panel as a Continuous Transmitter.
All other panels are designated as Disabled Transmitters.
nn: (0 - 255) Node ID of the panel to be enabled as a Continuous Transmitter.

TRANSMIT SHORT SPAN CONTROL: ESC [nn |

Function: Host designates the specified panel as a Short Span Transmitter.
All other panels are designated as Disabled Transmitters. If this command is sent with an ID of 0 to a Permanent Transmitter, the Permanent Transmitter terminates its transmission with an escape sequence ESC [0 |
nn: (0 - 255) Node ID of the panel to be enabled as a Short Span Transmitter.

3.2.8. Miscellaneous

INCREASE BRIGHTNESS: ESC [? 5 h

Function: Increases the brightness of the panels screen
NON-STANDARD EXTENSION

DECREASE BRIGHTNESS: ESC [? 5 l

Function: Decreases the brightness of the panels screen
NON-STANDARD EXTENSION

INCREASE BACKLIGHT: ESC [? 6 h

Function: Increases backlight intensity of the panel screen
NON-STANDARD EXTENSION

DECREASE BACKLIGHT: ESC [? 6 l

Function: Decreases backlight intensity of the panel screen
NON-STANDARD EXTENSION

BACKLIGHT ON: ESC [? 6 f

Function: Set full backlight intensity of the panel screen
NON-STANDARD EXTENSION

BACKLIGHT OFF: ESC [? 6 o

Function: Turn off backlight intensity of the panel screen
NON-STANDARD EXTENSION

4. Multi Drop Operation

4.1. Description

The VT100 panels can be configured in either point to point or multi-drop configurations. In the multi-drop configuration, a number of panels, each sharing a common transmit line and a common receive line, can be attached to a single host. The host unit might be a computer or a PLC, programmed to control the multi-drop network.

The type of configuration required can be specified in the Communication menu of the panel. The default configuration is point to point. The multi-drop configuration can be enabled by specifying YES for the Multi Drop option.

In the multi-drop configuration each panel can be enabled or disabled as a Receiver. A disabled Receiver only listens for the multi-drop commands from the host. It ignores any other data that is transmitted from the host. Each panel can also be disabled as a Transmitter or enabled as a Permanent Transmitter or as a Short Span Transmitter.

A Disabled Transmitter does not transmit any data at all to the host. A Permanent Transmitter is free to transmit to the host until the host disables it as a transmitter. A Short Span Transmitter uses a simple token passing mechanism. A Short Span Transmitter transmits all of the current data in its' transmit buffer to the host. When the transmit buffer is empty it terminates its transmission by passing the transmission token (the right to transmit) back to the host together with the ID of the next panel that should receive the token. The host can then enable the specified panel as the next Short Span Transmitter.

In the multi-drop configuration, each panel must be assigned a unique ID number between 1 and 255. An ID of 0 is used as a NULL ID. A panel can be assigned a NULL ID but in this case it does not transmit or receive in the multi-drop configuration. Each panel is also given the node ID of the next panel that it is attached to in the network. In this way a network ring can be created

4.2. Multi Drop Menu Items

The Multi Drop menu items are included in the Communications Menu.

Multi Drop: NO/YES
Node ID: 0 - 255
Next Node ID: 0 - 255

Multi Drop is enabled by selecting YES and disabled by selecting NO. The default value is NO, for point to point connection.

4.3. Multi Drop Escape Sequences

The following escape sequences are supported for multi-drop operation.

Receive Control	ESC [nn {
Transmit Continuous Control	ESC [nn }
Transmit Short-Span Control	ESC [nn

4.4. Implementation Of Multi Drop Networks

To maintain the integrity of the network it is vital that only one panel transmits at any given moment. The use of the Short Span Transmitter command ensures this. It should be noted that using only the Permanent Transmitter command does not necessarily ensure this. When a Permanent Transmitter command is sent, the specified panel is enabled as the new Permanent Transmitter and the previous Transmitter is disabled. However, due to turn around delays and processing time, it is likely that the previous Permanent Transmitter will transmit one character, after having received the new Permanent Transmitter command, before fully disabling its transmissions. This can compromise the integrity of the network if the new Permanent Transmitter starts transmitting immediately.

There are three basic methods of ensuring correct operation of the network.

- Using Short Span Transmitter commands in a self perpetuating manner.
- Continuous polling using Short Span Transmitter commands.
- Continuous polling using Permanent Transmitter commands - but terminating each Permanent Transmitter with a Short Span Transmitter command.

The key to successful operation in each of these methods is the use of the Short Span Transmitter commands.

Each of these methods are explained below.

4.4.1. Self Perpetuating Short Span Transmissions.

When a panel receives a Short Span Transmitter command from the host, with an ID corresponding to its own ID, it transmits any current data in its transmit buffer and then terminates its transmission with another Short Span Transmitter command. The value of the Next Node ID field, entered in the communication menu, is used by the panel as the ID for this command. The command is sent to the host.

When the host receives the Short Span Transmitter command from the panel it can safely assume that the panel has completely finished its transmissions. The host can then use the Node ID, included in the command from the panel, as the parameter for the next Short Span Transmitter command. The process is then repeated using the response from the newly specified Short Span Transmitter as the Node ID for the next Short Span Transmitter command from the host.

A self perpetuating network is created by forming a ring of panels. Each panel points to the next panel in the network, and the last panel in the network points back to the first panel.

The benefit of this method is that the host does not have to be aware of the configuration of the network. It only has to know the Node ID of the first panel in the network. The network is configured by specifying the Node IDs and the Next Node IDs of the panels. This makes it easy to link in new nodes to the network as the host program does not need to be modified.

The drawback with this method is that if a panel goes off line, or if a communication error occurs while the Short Span Transmitter Command is being sent, the whole network could come to a halt.

4.4.2. Continuous Polling Using Short Span Transmissions.

This method is a variation on the one described above. It is similar in the sense that only Short Span Transmitter commands are used, and that the host waits for the Short Span Transmitter command in response from the panel before assigning a new Short Span Transmitter. The difference in the method lies in the fact that the host ignores the Node ID, specified in the Short Span Transmitter command, sent by the panel. Instead, the host decides for itself which node should be assigned as the next Short Span Transmitter.

The benefit of this method is that the network becomes more robust and more able to recover from errors. The host can determine if a node has gone off line by using time-out techniques. If the time-out period elapses with no response from the panel, the host can simply assign the next panel as the Short Span Transmitter.

The drawback of this method is that the host has to be aware of the configuration of the network. It has to know the node IDs of all the panels attached to the network. This makes it more time consuming to link in new nodes to the network as the host program has to be updated.

4.4.3. Continuous Polling Using Permanent Transmissions.

In this method, a panel is assigned as a Continuous Transmitter by the host. The host waits for a certain amount of time and then places the Continuous Transmitter into a temporary Short Span Transmission mode by sending it a Short Span Terminator command with a Node ID of 0. This places

the Continuous Transmitter into a temporary Short Span Transmission state. In this state, when the panel has finished transmitting its data, it terminates its transmission with a Short Span Terminator command with an ID of 0.

This method is similar to the Continuous polling using short span transmissions. It also has the same advantages and disadvantages over the Self Perpetuating Short Span Transmissions method.

However, it has the further disadvantage, that for each active node the host has to send two Multi Drop command sequences as opposed to one.

4.5. Special Considerations When Using Multi Drop Configuration

- Every time a panel configured for Multi Point operation enters Terminal Mode it is initialized to a default state of Enabled Receiver and Disabled Transmitter. When a panel exits Terminal Mode and then reenters Terminal Mode it is NOT initialized to its previous state but rather, is initialized as described above.
- The VT100 Report commands require a response from the panel to the host. These commands are Device Status, Cursor Position Report and Identify Terminal. When a panel is configured for Multi Point operation, these commands are ignored unless the panel is Enabled as both a Receiver and a Transmitter when it receives these commands.
- Each panel has a transmission buffer that can contain 256 characters. If a panel is configured for Multi Drop operation it is possible that this buffer will become full if the panel is left for long periods of time in a state of Disabled Transmission.
- When software flow control is enabled in a multi drop network all panels listen for XON and XOFF characters from the host even if they are disabled as Transmitters and Receivers. This means that if the host sends an XOFF character, but no matching XON character, while one panel is enabled as a transmitter, and then assigns a new panel as the transmitter, the new panel will not start transmitting until it receives an XON character from the host.

5. Support Of Double Size Characters

Only the following VT100 panels support Double sized character attributes:

25x80 EL
25x80 LCD

The VT100 panels provide a limited support for double size characters. The escape sequences ESC #3, ESC #4 and ESC #5 are supported to enable the user to change the character size for a line of characters. When the character mode for a line is changed all the newly received characters on the same line as the current cursor position are displayed according to the new character mode. The character mode for a given line is not carried onto the next line following a line feed. The character mode for each line has to be set individually. By default the character mode for each line is the normal single sized character.

The character mode of a given line can be changed repeatedly between the 3 different character modes. For example the character mode for a given line could be set to double height top, then it could be set to normal and then to double height bottom.

To use double sized characters with the VT100 panels that support them, it is necessary to install a particular font in the panel. This font can be installed with Windows Designer. Within Windows Designer the font should first be selected using the Panel SetUp dialog box. The specified font is installed by simply downloading the project file to the panel.

The font that comes with Windows Designer, that supports double sized characters, is called VT8X16.FON.

This font should be sufficient for most users requirements. However, for certain applications it might be necessary for the user to create a new font file with specialized handling of double sized characters. The following information in this section is provided for these users. For users who simply use VT100.FON the following information is not needed.

6. Double Sized Characters

6.1. Method Of Double Sized Character Support

The double sized characters for the VT100 emulation are supported by specifying a number of special characters in the font file that is downloaded to the panel. Each double sized character displayed by the panel is composed of 4 normal sized characters stored within the font file. The 1st normal sized character is used to display the top left quarter of the double sized character, the 2nd normal sized character is used to display the top right quarter of the double sized character, the 3rd normal sized character is used to display the bottom left quarter of the double sized character and the fourth normal sized character is used to display the bottom right quarter of the double sized character.

To display each double sized character, the VT100 panel uses a different 4 of these special characters in the font file. For example, to display a double sized 'A' the VT100 looks in one location in the font file and extracts the four characters, used to compose the large character. To display a double sized 'B' the VT100 looks in a different location in the font file and extracts the four characters.

The special characters used to compose the large characters are placed in the section or sections of the font file that can be downloaded to the panel.

Since the number of downloadable characters in the font file is limited, so also is the number of characters that can be displayed as double sized characters. To display all the letters of the alphabet as double sized characters, 104 special characters are needed. To display all the numeric characters as double sized characters, 40 special characters are needed. Since there is not enough room to specify separate double sized characters for uppercase and lowercase characters, double sized characters are always displayed in uppercase.

6.2. Double Sized Characters In The Font File

The special characters for the double sized characters do not all have to be placed contiguously in the font file. The special characters can be divided into a number of different blocks. The characters within a particular block have to be contiguous in the font file, but the different blocks can be placed in different locations in the font file.

The individual characters that are used to compose a single double sized character have to be placed in the font file contiguously and in a certain order. The first character must be the character used to compose the upper left quarter of the double sized character, the next character must be that for the upper right quarter, followed by the character for the bottom left quarter and finally by the character for the bottom right quarter.

Within a single block of double sized character data one final restriction applies to the way the characters are ordered. There can be no gaps in the double sized character sequence, and the data for the double characters has to be in ascending ASCII order. For example, the 4 special characters used to compose a double sized 'A' have to be followed by the 4 special characters used to compose a double sized 'B' which in turn have to be followed by the 4 special characters used to compose a double sized 'C'. Within a single block the 4 special characters used to compose a double sized 'A' cannot be followed by the 4 special characters used to compose a double sized 'C'.

6.3. Double Sized Character Data Specification In DISPLAYS.INI

The structure of the double sized character blocks in the font file can be defined via an entry in the DISPLAYS.INI file. The new entry is called VT100BigChar and is placed in the font description sections in the file. For example, for the VT8X16 font it has the following form:

```
[VT8X16 Font]
BargraphStart=256
VT100BigChar=1,3,5,4,53,4,26,4,65,128,5,4,48,232
```

The data for the entry has the following structure:

- | | |
|-----------|--|
| Number 1 | - Specifies if Big Characters are supported in the font file. 1 supported, 0 not supported. |
| Number 2 | - Specifies the number of blocks of big characters to follow. |
| Number 3 | - Number of big characters in block 1. |
| Number 4 | - Number of normal characters needed to make one big character for block 1. (must be 4). |
| Number 5 | - The ASCII code of the first normal character that will be doubled for block 1 |
| Number 6 | - The ASCII code of the first double character element used to make a big character out of the normal character specified in the previous entry, for block 1 |
| Number 7 | - Number of big characters in block 2. |
| Number 8 | - Number of normal characters needed to make one big character for block 2. (must be 4). |
| Number 9 | - The ASCII code of the first normal character that will be doubled for block 2 |
| Number 10 | - The ASCII code of the first double character element used to make a big character |

out of the normal character specified in the previous entry, for block 2

and so on for all the blocks specified in Number 2.

If the value for Number 1 is 0, or if any of the data in the VT100 BigChar entry is not valid, or if there is no VT100 BigChar entry in the DISPLAYS.INI file for the font being used then, when the project file is downloaded to UniOP, the panel will not support the changing of the character mode to double size.

7. Project File

The project to be downloaded to UniOP has to contain one page with a help message explaining how to enter configuration mode, how to change the display brightness or how to restart the VT100 emulation. For a small 2×20 display, this message could be: "Hold ENTER for 2 sec to see more...".

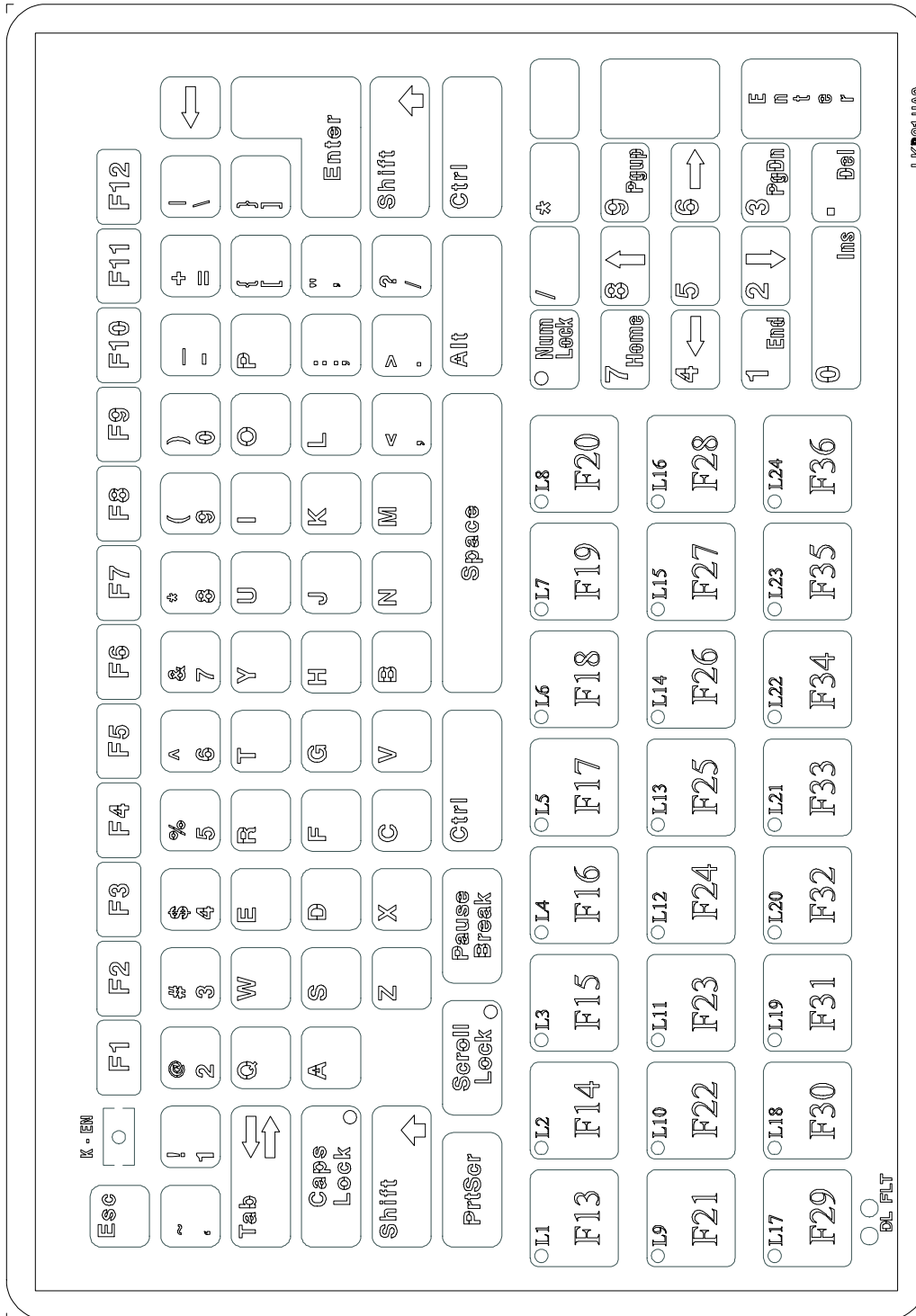
This page is displayed only after the menu item Configuration mode-> is selected and executed. Note that the standard UniOP keyboard commands (page select, scroll, etc.) are disabled during normal terminal emulation or SetUp mode. They are enabled only when this page is displayed.

8. Special Support for the AT-F ASCII keyboard

This section is short reference for the use of the AT-F ASCII keyboard with the VT100 Emulation protocol.

Key code assignment and LED positions are described along with all additional escape sequences.

8.1. Keyboard Layout



8.2. VT100 key codes

Key	normal		shift		ctrl
	hexadecimal	ASCII	hexadecimal	ASCII	
ESC	0x1B	esc	0x1B	esc	
F1	0x1B 0x4F 0x50	esc OP	0x1B 0x4F 0x50	esc OP	
F2	0x1B 0x4F 0x51	esc OQ	0x1B 0x4F 0x51	esc OQ	
F3	0x1B 0x4F 0x52	esc OR	0x1B 0x4F 0x52	esc OR	
F4	0x1B 0x4F 0x53	esc OS	0x1B 0x4F 0x53	esc OS	
F5	0x1B 0x4F 0x77	esc Ow	0x1B 0x4F 0x77	esc Ow	
F6	0x1B 0x4F 0x78	esc Ox	0x1B 0x4F 0x78	esc Ox	
F7	0x1B 0x4F 0x79	esc Oy	0x1B 0x4F 0x79	esc Oy	
F8	0x1B 0x4F 0x6D	esc Om	0x1B 0x4F 0x6D	esc Om	
F9	0x1B 0x4F 0x74	esc Ot	0x1B 0x4F 0x74	esc Ot	
F10	0x1B 0x4F 0x75	esc Ou	0x1B 0x4F 0x75	esc Ou	
F11	0x1B 0x4F 0x76	esc Ov	0x1B 0x4F 0x76	esc Ov	
F12	0x1B 0x4F 0x6C	esc Ol	0x1B 0x4F 0x6C	esc Ol	

Key	normal		shift		ctrl
	hexadecimal	ASCII	hexadecimal	ASCII	
~	0x60	`	0x7E	~	
1!	0x31	1	0x21	!	
2@	0x32	2	0x40	@	
3#	0x33	3	0x23	#	
4\$	0x34	4	0x24	\$	
5%	0x35	5	0x25	%	
6^	0x36	6	0x5E	^	
7&	0x37	7	0x26	&	
8*	0x38	8	0x2A	*	
9(0x39	9	0x28	(
0)	0x30	0	0x29)	
-_	0x2D	-	0x5F	_	
+ =	0x3D	+	0x2B	=	
\	0x5C	\	0x7C		
BACKSPACE	0x08		0x08		
TAB	0x09		0x1B 0x5B 0x58 0x54	esc [XT	
Q	0x71	q	0x51	Q	0x11
W	0x77	w	0x57	W	0x17
E	0x65	e	0x45	E	0x05
R	0x72	r	0x52	R	0x12
T	0x74	t	0x54	T	0x14
Y	0x79	y	0x59	Y	0x19
U	0x75	u	0x55	U	0x15
I	0x69	I	0x49	I	0x09
O	0x6F	o	0x4F	O	0x0F
P	0x70	p	0x50	P	0x10
[{	0x5B	[0x7B	{	
]}	0x5D]	0x7D	}	

Key	normal		shift		ctrl
	hexadecimal	ascii	hexadecimal	ascii	
CAPS LOCK					
A	0x61	a	0x41	A	0x01
S	0x73	s	0x53	S	0x13
D	0x64	d	0x44	D	0x04
F	0x66	f	0x46	F	0x06
G	0x67	g	0x47	G	0x07
H	0x68	h	0x48	H	0x08
J	0x6A	j	0x4A	J	0x0A
K	0x6B	k	0x4B	K	0x0B
L	0x6C	l	0x4C	L	0x0C
;	0x3B	;	0x3A	:	
‘ ‘	0x27	‘	0x22	“	
ENTER	0x0D		0x0D		
SHIFT					
Z	0x7A	z	0x5A	Z	0x1A
X	0x78	x	0x58	X	0x18
C	0x63	c	0x43	C	0x03
V	0x76	v	0x56	V	0x16
B	0x62	b	0x42	B	0x0A
N	0x6E	n	0x4E	N	0x0E
M	0x6D	m	0x4D	M	0x0D
, <	0x2C	,	0x3C	<	
. >	0x2E	.	0x3E	>	
/ ?	0x2F	/	0x3F	?	
PRTSCR	0x10		0x10		

		hexadecimal	ASCII
SCROLL LOCK	On	0x1B 0x5B 0x58 0x31	esc [X1
	Off	0x1B 0x5B 0x58 0x30	esc [X0
PAUSE BREAK		0x1B 0x5B 0x58 0x58	esc [XX

Key	normal		shift		ctrl
	hexadecimal	ASCII	hexadecimal	ASCII	
CTRL		ctl		ctl	
SPACE	0x20		0x20		
ALT					
F13	0x1B 0x4F 0x71	esc Oq	0x1B 0x4F 0x71	esc Oq	
F14	0x1B 0x4F 0x72	esc Or	0x1B 0x4F 0x72	esc Or	
F15	0x1B 0x4F 0x73	esc Os	0x1B 0x4F 0x73	esc Os	
F16	0x1B 0x4F 0x70	esc Op	0x1B 0x4F 0x70	esc Op	
F17	0x1B 0x4F 0x6E	esc On	0x1B 0x4F 0x6E	esc On	
F18	0x1B 0x4F 0x4D	esc OM	0x1B 0x4F 0x4D	esc OM	
F19	0x0A	ctl J	0x0A	ctl J	
F20	0x08	ctl H	0x08	ctl H	
F21	0x1B 0x46 0x32 0x31	esc F21	0x1B 0x46 0x32 0x31	esc F21	
F22	0x1B 0x46 0x32 0x32	esc F22	0x1B 0x46 0x32 0x32	esc F22	
F23	0x1B 0x46 0x32 0x33	esc F23	0x1B 0x46 0x32 0x33	esc F23	
F24	0x1B 0x46 0x32 0x34	esc F24	0x1B 0x46 0x32 0x34	esc F24	
F25	0x1B 0x46 0x32 0x35	esc F25	0x1B 0x46 0x32 0x35	esc F25	
F26	0x1B 0x46 0x32 0x36	esc F26	0x1B 0x46 0x32 0x36	esc F26	
F27	0x1B 0x46 0x32 0x37	esc F27	0x1B 0x46 0x32 0x37	esc F27	
F28	0x1B 0x46 0x32 0x38	esc F28	0x1B 0x46 0x32 0x38	esc F28	
F29	0x1B 0x46 0x32 0x39	esc F29	0x1B 0x46 0x32 0x39	esc F29	
F30	0x1B 0x46 0x33 0x30	esc F30	0x1B 0x46 0x33 0x30	esc F30	
F31	0x1B 0x46 0x33 0x31	esc F31	0x1B 0x46 0x33 0x31	esc F31	
F32	0x1B 0x46 0x33 0x32	esc F32	0x1B 0x46 0x33 0x32	esc F32	
F33	0x1B 0x46 0x33 0x33	esc F33	0x1B 0x46 0x33 0x33	esc F33	
F34	0x1B 0x46 0x33 0x34	esc F34	0x1B 0x46 0x33 0x34	esc F34	
F35	0x1B 0x46 0x33 0x35	esc F35	0x1B 0x46 0x33 0x35	esc F35	
F36	0x1B 0x46 0x33 0x36	esc F36	0x1B 0x46 0x33 0x36	esc F36	

Key	normal		shift		ctrl
	hexadecimal	ascii	hexadecimal	ascii	
NUM LOCK					
/	0x2F	/	0x2F	/	
*	0x2A	*	0x2A	*	
-	0x2D	-	0x2D	-	
+	0x3D	+	0x3D	+	
ENTER	0x0D		0x0D		

	NumLock ON		NumLock Off		
. DEL	0x2E		0x1B 0x5B 0x50	esc [P	
0 INS	0x30	0			
1 End	0x31	1	0x1B 0x5B 0x32 0x35 0x3B 0x38 0x30 0x48	esc [25;80H	
2 down	0x32	2	0x1B 0x5B 0x42	esc [B	
3 PgDn	0x33	3	0x1B 0x5B 0x32 0x35 0x42	esc [25B	
4 left	0x34	4	0x1B 0x5B 0x44	esc [D	
5	0x35	5	0x35	5	
6 right	0x36	6	0x1B 0x5B 0x43	esc [C	
7 Home	0x37	7	0x1B 0x5B 0x48	esc [H	
8 up	0x38	8	0x1B 0x5B 0x41	esc [A	
9 PgUp	0x39	9	0x1B 0x5B 0x32 0x35 0x41	esc [25A	